THE MOTOR FUEL TAX: A CRITICAL SYSTEM AT RISK

Framing the Problem for Connecticut

A Policy White Paper
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The motor fuel tax has served as the primary source of transportation funding in the U.S. for close to 100 years. It has been a simple, almost invisible form of indirect user fee, based on the amount of fuel consumed. Simply stated, the more a vehicle is driven, the more fuel that is consumed and hence the more road usage tax that is paid. It is elegant in its efficiency, widely accepted by the public and probably doomed to fail in the future, at least in its current form.

How can such a steady and dependable funding source be at risk? The simple reality is that our primary source of funding is based on the taxation of **fuel consumed**, and ***not* actual miles driven**. As fuel efficiency increases, and we move toward alternative fuel vehicles, drivers will be using less fuel. That's good for reducing vehicle exhaust emissions and our dependency on foreign oil supplies, but it is bad for transportation funding, as long as we continue to primarily rely on the gas tax as our major funding source.

It is a notable policy contradiction that transportation funding in the US is based on taxation of a commodity that our nation is trying to discourage the use of. Increased fuel efficiency is being driven primarily by dramatically higher Corporate Average Fuel Efficiency ("CAFE") standards, but automotive technology developments and market forces are also driving the change. . The federal government is offering significant tax incentives toward the purchase of all-electric vehicles, auto makers are rapidly developing plug in hybrids (PHEV) and full battery electric vehicles (BEV), and battery technology is rapidly approaching a level that will make it economically feasible to produce cars capable of driving 200-300 miles on a single charge.

According to the University of Michigan Transportation Research Institute [(1)], the average fuel efficiency of passenger cars and other light vehicles sold in the U.S. increased almost **22 percent** between 2008 and 2014. It has remained steady in recent months due to a significant drop in fuel prices, but will undoubtedly increase further as auto makers try to achieve an average new car fleet efficiency of more than **54 MPG, by 2025** (just 9 years away). State and federal gas tax revenues have already shown a significant impact, and the Federal Highway Trust Fund has been largely on life support for about 5 years or more.

The average fuel efficiency of cars and other light vehicles sold in the U.S. increased 22% between 2008 and 2014.

The problem is further compounded by a clear reluctance on the part of elected officials to increase tax rates, motor fuel or otherwise. The federal gas tax has been set at $0.184 per gallon (higher for diesel) for more than two decades. Some states have elected to index portions of the state gas tax to inflation. But that will not deal with the problem of dramatic future increases in fuel

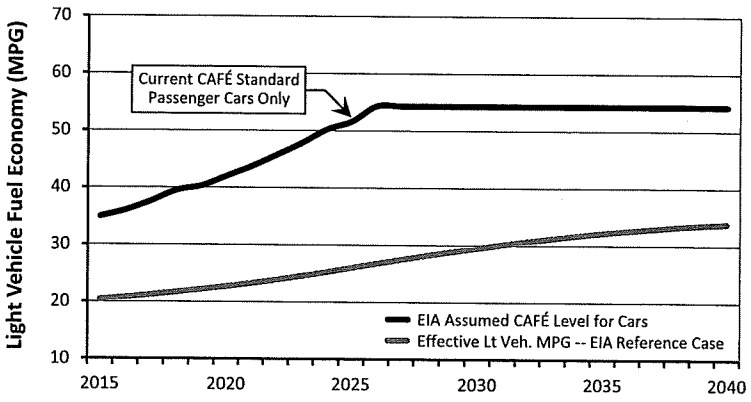
efficiency; and the resulting phenomena where vehicle miles of travel (VMT) and demand for transportation increases while fuel consumption (and tax revenue) decreases.

This white paper will attempt to quantify the problem, both in terms of magnitude and timing. It is most important to take a good look at the future outlook; because the problems will not be solved overnight. It will take time to define, test and deploy alternative revenue systems; but the first step is to size up the problem, before it is too late. The white paper will also address some potential solutions, including strategic opportunities and some significant challenges that may need to be solved in the future.

How Serious is the Problem?

The recent downturn in gas tax revenue is just a small glimpse at the problems to come. Indeed, some of the downturn arose from a reduction in vehicle miles of travel spurred by increasing gas prices and the Great Recession after 2008. Nationally, VMT is again rising, but fuel consumption is rising more slowly.

Perhaps one of the best recent outlooks of what the future holds is the latest official fuel consumption forecast prepared by the U.S. Energy Information Administration (EIA); the **EIA** 2016 "early release" **reference case** projection [(2)] contains important outlooks on annual fuel efficiency for cars and trucks, updated national VMT forecasts and **projected fuel demand** by travel market segment. In developing the estimate, EIA starts with the latest EPA CAFE passenger car fuel efficiency standards, shown in the black line in **Figure 1**. This actually refers only to new sales of passenger cars, which make up only a portion of the total light vehicle fleet. It does not include SUVs or pickup trucks, which also comprise a significant portion. Note that **EIA** assumes the CAFE goal of 54.3 MPG will be reached by 2025, but then assumes **no further increases** beyond that point. (Note: The CAFE goal for 2025 was recently reduced slightly to about 52.5 MPG as a result of the recent downturn in fuel prices).

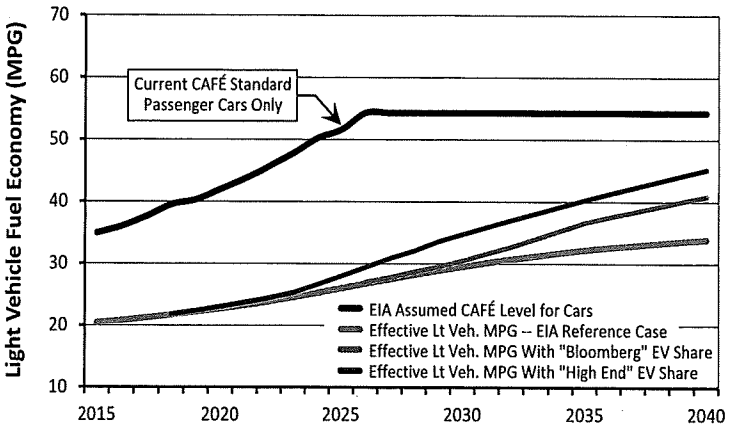


Source: Adapted from Energy Information Agency 2016 "early" Forecast. Also, Bloomberg New Energy Finance.
Note: CAFÉ standards apply only to passenger cars. Light vehicles include cars, SUV's and pickup trucks.

ESTIMATED LIGHT VEHICLE FUEL EFFICIENCY (MPG)

FIGURE 1

The green line displays the overall EIA estimated light vehicle fuel efficiency used in the "reference case". It is lower than the CAFE standards because it includes all light vehicles, including SUVs and pickups. The CAFE standard of 54.3 MPG relates only to passenger cars, and the CAFE standards relate only to new car sales. The overall fuel efficiency includes that of the entire light vehicle fleet, and includes both new and old cars. The entire light vehicle fleet typically takes more than 15 years to "turn over". The EIA projects average light vehicle mileage (including pickups and SUVS) to increase from about 20 MPG in 2015 to nearly 35 MPG by 2040, an increase of about 70 percent over the 25 years.



Source: Adapted from Energy Information Agency 2016 "early" Forecast. Also, Bloomberg New Energy Finance.
Note: CAFÉ standards apply only to passenger cars. Light vehicles include cars, SUV's and pickup trucks.

ESTIMATED LIGHT VEHICLE FUEL EFFICIENCY (MPG)

FIGURE 2

Electric Vehicles

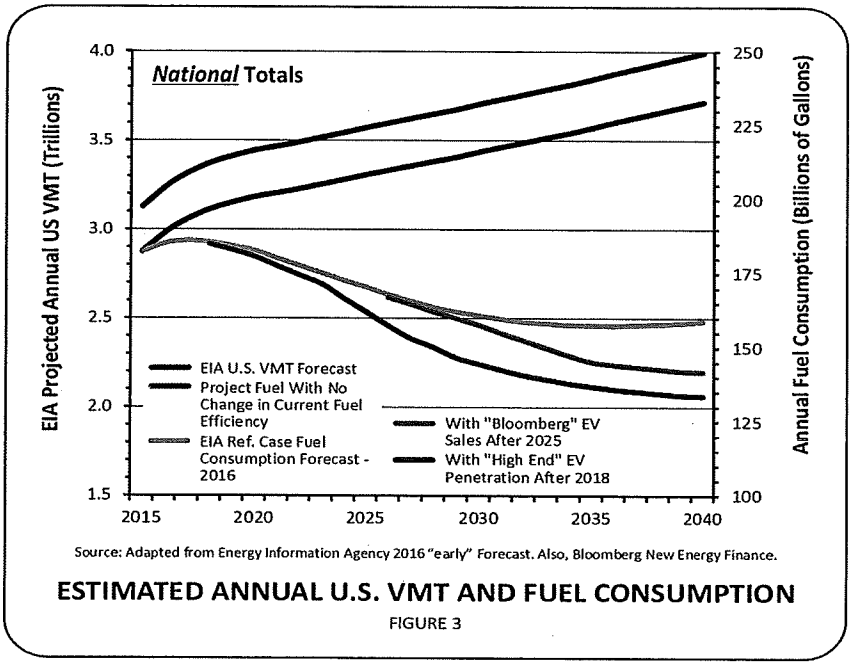
However, the **EIA projection** assumes no change in CAFE standards after 2025, right about the time electric vehicles are expected to begin to take off as a proportion of new car sales. **Bloomberg New Energy Finance** released a study in February, 2016 [3] which concluded that based on current trends in battery development and price declines, fully electric "plug in vehicles" will become more economical to buy and own than traditional internal combustion engine vehicles by the **mid-2020s**. They forecast that about **35 percent** of all new cars sold will be gasless electric vehicles (EV) **by 2040.** Their estimate for EV sales in 2040 will be more than 90 times the number sold annually today.

But even that forecast may prove to be conservative, based on recent developments and consumer behavior. Tesla recently announced it will be mass producing an electric vehicle (Tesla 3) which will sell for about $35,000 and get about 225 miles between plug in charges. It will begin delivery early in 2018; suggesting that the critical equivalent "price point" assumed by Bloomberg may be reached five years earlier. More importantly, over 400,000 US drivers have already pre-ordered the Tesla 3, a clear indication of strong market appetite. The Bloomberg analysis assumed about 8 percent of new car sales in 2025 would be all electric; based on the consumer reaction to the Tesla initiative, it may be a lot higher.

As such, in preparing the paper, we **developed two alternative fuel efficiency forecasts**, one based on Bloomberg and one developed by CDM Smith assuming an even higher EV penetration. These alternatives are compared with the official EIA projection in **Figure 2.**

With the intermediate case, aligned with the **Bloomberg** electric vehicle forecast, depicted in orange, average fuel efficiency would reach about **41 MPG by 2040**, as compared with about **34 MPG** in the EIA reference case. The "Bloomberg" forecast begins to depart from the EIA projection in 2025, when they believe EV lifecycle cost will generally be in line with internal combustion engine vehicles.

The "**High End**" electric vehicle penetration scenario assumes even more accelerated EV sales, as suggested by the early deployment and overwhelming advance sales of the Tesla 3. It begins to depart from the EIA case earlier (2018) and anticipates long range light vehicle fuel efficiency may well **reach 45 MPG**. That's about 125 percent better than today's average, and more than 28 percent higher than the EIA estimate in 2040. Bottom line: all three "future scenarios" show dramatic increases in fuel efficiency which will, no doubt, reduce fuel sales in the future, even as travel increases.



Source: Adapted from Energy Information Agency 2016 "early" Forecast. Also, Bloomberg New Energy Finance.

ESTIMATED ANNUAL U.S. VMT AND FUEL CONSUMPTION

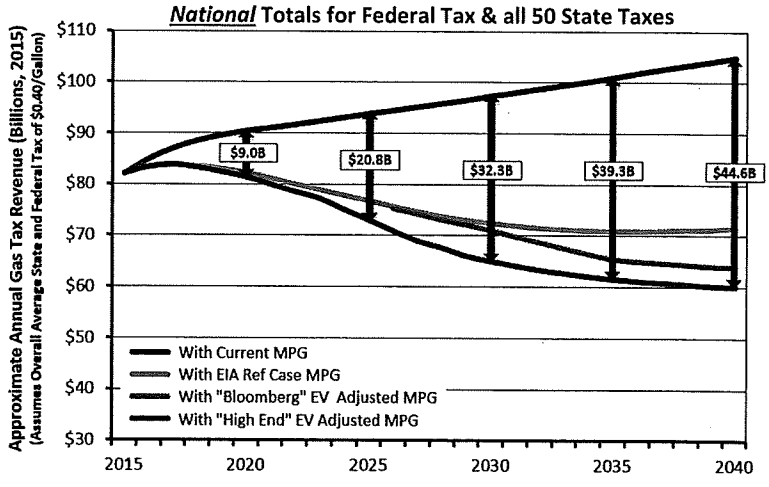
FIGURE 3

What it Means for Fuel Consumption and Gas Tax Revenue

Needless to say, this is not good news for fuel sales and gas tax revenue. The black line in **Figure 3** is the EIA estimate of total vehicle miles of travel in the U.S. that was used to estimate fuel demand. Total national VMT is expected to increase from about 3.1 trillion in 2015 to about 4.0 trillion in 2040, an increase of almost 30 percent over 25 years. Certainly not excessive growth, but it does show ever increasing demand on an aging and sometimes clogged infrastructure already behind in investment. The red line depicts what nationwide fuel sales would be if there was no increase in fuel efficiency, increasing from about 185 billion gallons in 2015 to nearly 235 billion gallons in 2040. This is completely hypothetical scenario, which will not occur if current EPA CAFE standards are to be met. We include it only for purposes of comparison with the three alternative "futures" to quantify potential impacts resulting directly from increasing fuel efficiency only.

With the projected increases in efficiency, and the shift to gasless electric vehicles, EIA projects (green line) that 2040 fuel sales will drop to around 155 billion gallons, a decrease of 16.3 percent in fuel while total travel increases by 30 percent. With the higher EV penetration (blue line) fuel sales would decline further, dropping to just 130 billion gallons in 2040. That's a 45 percent reduction in 2040 fully attributable to increased fuel efficiency. This will dramatically reduce transportation funding if we continue taxing gallons as opposed to miles.

Figure 4 takes a look at what it would mean for national gas tax revenue over the next 25 years. All values are displayed in 2016 dollars, generally based on today's tax rates. The federal gas tax rate is $0.184 per gallon,



APPROXIMATE STATE AND FEDERAL FUEL TAX REVENUE

2015 Dollars; Assumes Nominal $0.45/Gal. Combined Average Tax

FIGURE 4

while state gas tax rates vary. The overall average state rate is about $0.27 per gallon (including excise and some state additives), so a nominal overall $0.45 per gallon was used to calculate total fuel tax revenue. Obviously the estimates do not include other transportation taxes or sources of funding. In the absence of any further increase in fuel efficiency, as shown by the red line, national gas tax revenue would increase from about $82 billion in 2015 to about **$105 billion** in 2040. (all 2015 dollars)

However, the **EIA fuel forecast** would drop the 2040 figure to about **$71 billion**, and the "**high EV**" case to about **$60 billion**. The chart shows that gas tax revenue (in 2015 dollars) would actually peak over the next 2-3 years then begin to decline, unless tax rates are increased to make up the difference. By 2025, (just nine years from now), increasing fuel efficiency may cost state and federal coffers as much as $20.8 billion per year.

The **loss** will rise to over $33 billion by 2030 and almost **$45 billion by 2040**. It is a serious problem, especially when considering that current infrastructure funding levels are already well below needs even today.

By 2025, just nine years from now, increasing fuel efficiency may cost state and Federal coffers as much as $20.8 billion per year in fuel tax revenues!

Compounding the problem is a very clear reluctance on the part of elected officials to approve increases in fuel tax rates. The federal gas tax, for example, has not been increased in more than 20 years; and senior Congressional staff involved in negotiations on transportation funding have expressed that we may never see another increase in the federal motor fuel tax.

Some states have chosen to automatically adjust future fuel tax rates to keep pace with inflation. However, this indexing usually does not deal with the significant problem described above; that is, the reduction in fuel consumption due to increased fuel efficiency and the expected rapid future emergence of electric vehicles. Indexing helps by keeping pace with inflation, but is not a solution to this particular problem.

***CONNECTICUT*: What it Might Mean to CT**

Obviously, the questionable sustainability of the motor fuel tax is not just a national issue, but a Connecticut issue as well. Currently Connecticut has a two-tier fuel-related taxation system, and separate rates for gasoline/gasohol vs. diesel fuel.

For gasoline, the state charges a direct excise tax of **$0.25 per gallon**. In addition, all gasoline sales are subject to a Gross Receipts Tax (GRT) computed at **8.1 percent** of the wholesale price of gasoline. Historically the wholesale price of gasoline in the state was in the range of $2.75-$3.00, occasionally exceeding $3.00. The current statute (for gasoline only) set a wholesale price cap of $3.00 in computing the GRT portion of the tax. In recent years, the wholesale price has dropped considerably, to less than $1.50 in mid-2016. The GRT component of transportation revenue has declined significantly because of lower gas prices [4].

The GRT for gasoline is collected directly from the wholesale distributors; but the net cost is passed on the drivers through prices at the pump. At currently low wholesale cost levels, the **GRT** component is around **$0.12 per gallon**. When combined with the $0.25 per gallon excise tax, the total state fuel related tax per gallon of gasoline is about $0.37 per gallon. It has reached as high as almost $0.49 in early 2013 prior to the wholesale price decline in recent years. On the basis of the excise tax alone Connecticut is slightly higher than the average rate for the states, but is generally in the mid-range (17th highest). But when the GRT is included, Connecticut rises to the 3rd highest state gas tax rate in the nation, behind only Pennsylvania and Washington state[5].

The **diesel tax** structure is similar, but slightly different. Diesel fuel for highway use (essentially trucks) includes two components:

- A base excise rate of **$0.29 per gallon**, plus
- An additional rate based on **8.1 percent** of the wholesale price. This is similar to the gasoline levy, but with diesel it is added directly into the gas tax rate rather than the way it is done on gasoline sales.

At current wholesale prices for diesel, the variable component is around $0.129 per gallon, for a total diesel tax rate of about $0.419 per gallon. In recent years this has been as high as $0.549 per gallon.

The Connecticut Department of Transportation has developed estimates of future growth in population growth and vehicle miles of travel (VMT). These were used in this analysis. The state population is expected to increase from about 3.65 million is expected to grow to more than 4.0 million by 2040, and increase of about 10 percent over the next 25 years. This is a relatively low rate of growth, but will add significant traffic demand to the states roads nonetheless. Annual **VMT** in the state is expected to grow from about 31 billion miles today, to almost 36 billion miles per year by 2040; an increase of **16 percent**.

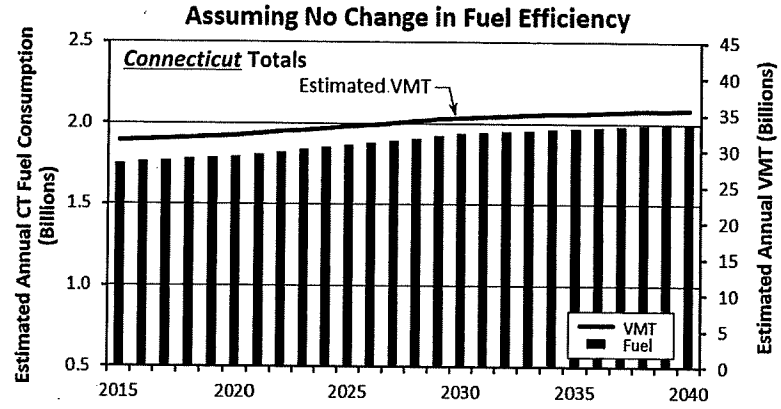
Estimated Impacts on *Fuel Consumption* in CT

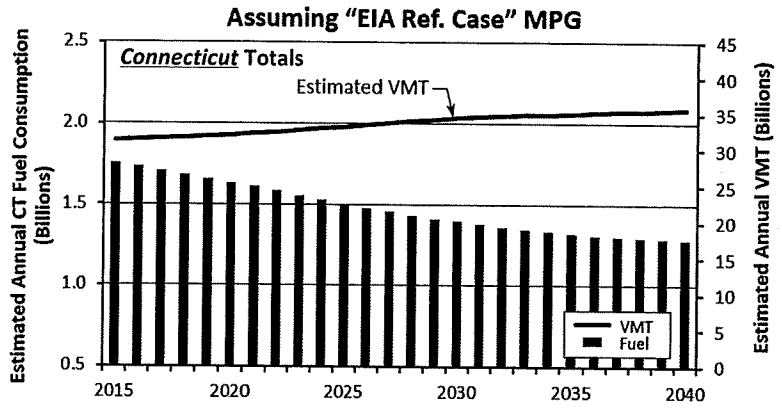
The 16 percent increase in statewide travel in Connecticut over the next quarter century will result in greater congestion, greater wear and tear on highways and bridges, and increased need for widening and rehabilitation. Even in today's dollars without inflation, it is reasonable to expect transportation funding by the year 2040 will need to be at least 20-25 percent greater than today.

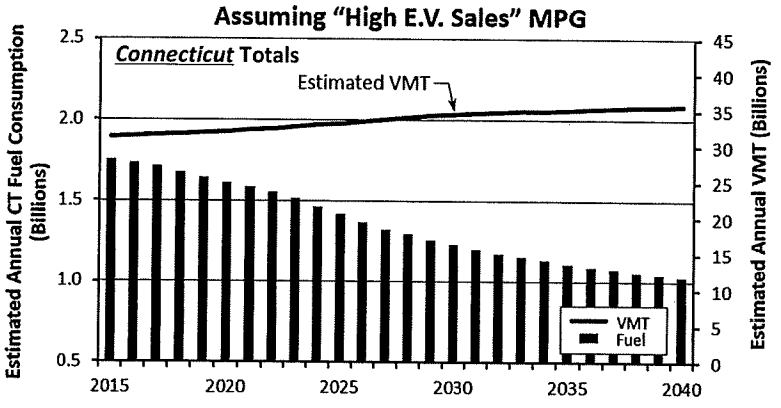
But with increasing fuel efficiency, fuel consumption in the state will likely decline, not increase with additional travel. **Figure 5** provides an important comparison of projected fuel sales in the state under three alternative scenarios.

The upper portion is purely hypothetical, and shows estimated annual fuel sales in Connecticut assuming there was no change in current fuel efficiency. This scenario does not reflect the reality that fuel efficiency will increase in the future. We include it in Figure 5 only for comparison with the other scenarios to help quantify the net impact on fuel sales which can be expected due to increased fuel efficiency in the future.

In the **hypothetical scenario** without future fuel efficiency increases, Connecticut fuel sales of about **1.7 billion** gallons in **2015** (including both gasoline and Diesel) would be projected to increase to over **2.0 billion** gallons by **2040**—directly in proportion to estimated increases in vehicle miles of travel.







ESTIMATED CONNECTICUT ANNUAL VMT AND FUEL SALES

FIGURE 5

The center portion of the graphic shows estimated statewide fuel consumption using the Energy Information Administration (EIA) "Reference Case" MPG forecast. Here we see fuel consumption declining to less than 1.3 billion gallons per year by 2040, even in the face of increasing travel.

The **worst case scenario,** which assumes a "**high end**" electric vehicle sales, shows further declines, with Connecticut annual fuel sales dropping to just over 1.0 billion gallons. This is nearly a 50 percent reduction in fuel sales as compared to a "no change" MPG scenario.

Needless to say, it would have a significant impact on revenue collected from fuel taxes and GRT in the state. In addition, it will also dramatically reduce the revenue provided to the state from the federal gas tax as well, although recent shortfalls in the Highway Trust Funds have been covered by transfer from the federal General Fund or other sources. At some point in the future, funding from the HTF to the states will likely begin declining with declining fuel sales.

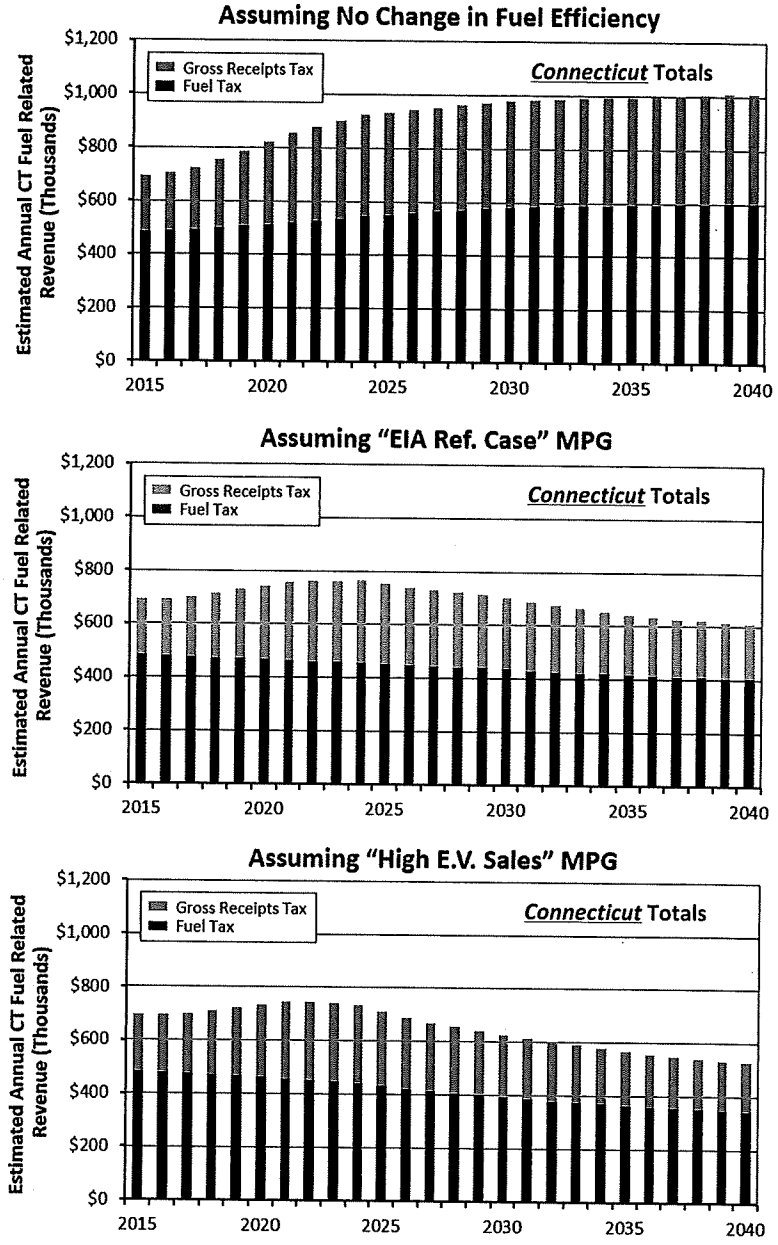
Impacts on Fuel Tax *Revenue* in CT

As might be expected, declines in fuel sales will result in declining fuel tax revenue. **Figure 6** shows a computation of projected Connecticut fuel-related tax revenue. Once again three "future scenarios" are compared, the hypothetical case with assuming no change in current fuel efficiency (not likely) and two

of the alternative scenarios, the EIA reference case and the "high EV sales" case. The latter scenario probably represents a "worse case" outlook.

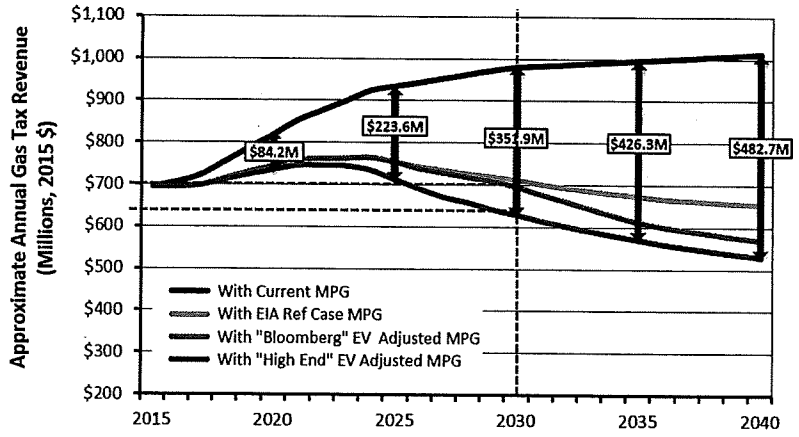
For each scenario, Figure 6 presents estimated annual revenue, in nominal 2016 dollars. The estimates include both the excise tax rates and revenue from the Gross Receipts tax (GRT). Revenue from the gas tax itself is shown in the darker color in each column, while the lighter color represents revenue from the GRT, as applied to gasoline sales only. For diesel, the effective GRT rate is included directly in the "fuel tax" portion.

All three conditions initially shown increases in revenue for the first several years. This is primarily coming from the GRT component, as the projections assume a gradual increase in wholesale gas prices from the very low rates they are today. The wholesale price is assumed to reach $3.00 per gallon by around 2024 and remain constant thereafter. This reflects the current cap on the reference wholesale rate used in computing GRT on gasoline.



ESTIMATED CONNECTICUT FUEL- RELATED TAX REVENUE
Assuming Continuation of the Current CT Tax Rates
Note: Includes gasoline tax, diesel tax and Gas GRT Revenue
FIGURE 6

After 2025, overall fuel-related revenue continues to grow in the hypothetical condition where average MPG does not change. However, when using the official **EAI forecast** future MPG assumptions we see steady declines after 2025. The decline is even more pronounced with the "**high EV" scenario**. Revenue from the gas tax itself actually begins to decline within the next few years, but in Connecticut this will be



APPROXIMATE CONNECTICUT FUEL TAX REVENUE
Assuming Continuation of the Current $0.493 CT Tax Rate
Note: Includes gasoline tax, diesel tax and Gas GRT Revenue

FIGURE 7

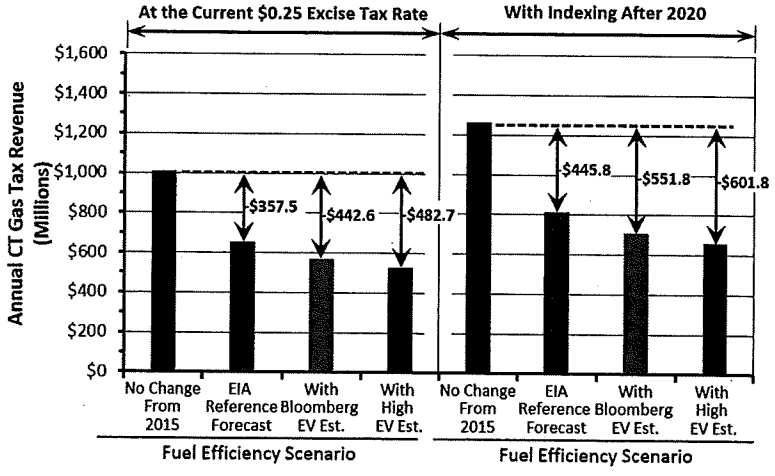
offset by assumed increasing fuel costs. But over the longer term we begin to see very big declines in both the base tax and the GRT revenue.

Figure 7 compares total fuel-related revenue in Connecticut (excluding the Federal gas tax of course) under the constant MPG vs. each of the three alternative scenarios tested. The red line shows estimated revenue with no change in current MPG. The green curve shows estimated Connecticut gas tax revenue assuming the EIA reference case. The orange and blue lines show the higher fuel efficiency scenarios, based largely on potential accelerated estimates of electric vehicle sales.

As shown in Figure 7, by the year **2025**, just nine years away, Connecticut annual **gas tax revenue will be reduced** by over **$223 million**, at current tax rates, due to increased fuel efficiency. By **2035**, the impact is estimated at **$352 million**, and by **2040**, the annual revenue impact is estimated at more than **$482 million**; again all in 2015 dollars unadjusted for inflation. (Wholesale gas prices are assumed to gradually increase but nominal excise tax rates per gallon are not).

Figure 8 presents a comparison of fuel tax revenues for each of the four forecast scenarios, **at 2040 levels**. The left half of the graph shows estimated revenue assuming there is no further change in the Connecticut effective gas tax rate of about $0.493 per gallon. This includes both the $0.25 base excise tax plus the equivalent GRT component per gallon. Revenue from the GRT assessed on gasoline is assumed to increase as the wholesale price is assumed to increase, up to the maximum of $3.00 per gallon.

The right side of the graph compares fuel-related revenue assuming annual **indexing** is hypothetically introduced to the excise tax portion only from



COMPARISON OF 2040 CONNECTICUT FUEL TAX REVENUES
Note: Includes gasoline tax, diesel tax and Gas GRT Revenue

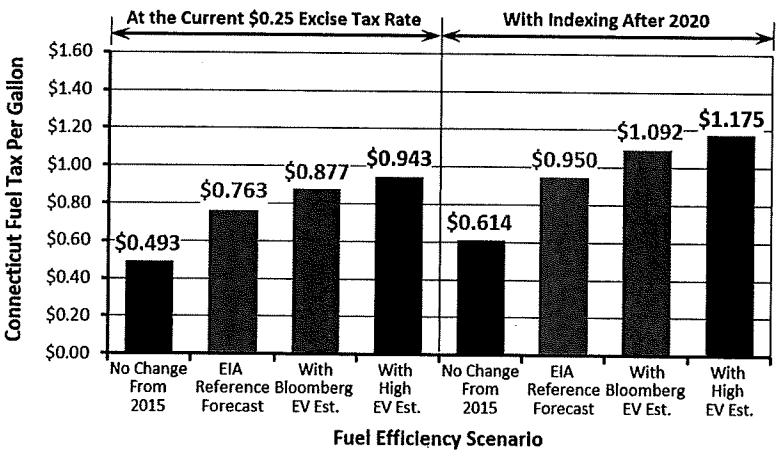
FIGURE 8

2020 and beyond. This case assumes nominal annual inflation of 2.0 percent per year; after 2020.

At current tax rates, it is estimated total state fuel-related tax revenue would be around **$1.0 billion** in 2040, including all sources defined above. Using the EIA reference forecast, this **drops to about $654 million**, a net decrease of over $357 million; entirely attributable the increased fuel efficiency. Assuming the Bloomberg electric vehicle forecast scenario, the net impact is estimated at about $443 million and with the high end electric vehicle forecast the reduction in 2040 annual revenue is estimated at more than $482 million. That's **nearly a 50 percent reduction** in fuel tax revenue **attributed exclusively to increased fuel efficiency**.

When we consider the impacts in future year indexed dollars, even the EIA reference case forecasts, which may well prove to be conservative, show a decline in future revenue of about $552 million, even after indexing. This increases to as much as $602 million reduction for the other scenarios.

How high would Connecticut gas tax rates have to increase to offset the loss of revenue caused by higher fuel efficiency? This is addressed in **Figure 9**. Gas tax rate levels are shown with and without nominal indexing (after 2020). Even without indexing, the overall gasoline effective tax rate will increase to about $0.493 due to the assumed increase in the wholesale price of gasoline. The excise portion is assumed to remain at $0.25. With the 2 percent per year overall indexing, if there is no change in current fuel efficiency, the current rate per gallon would nominally increase to about $0.614 per gallon, including the inflation adjusted excise tax of $0.371 per gallon.



ESTIMATED 2040 CONNECTICUT FUEL TAX RATES

Note: Rates shown are for gasoline tax only; smaller increases may be needed in diesel tax rates.

FIGURE 9

However, if the State wishes to generate revenue in the year 2040, commensurate with the amount of estimated travel, fuel tax rates would have to be increased above current levels as described for the two scenarios below.

EIA Reference Forecast. Using the EIA reference forecast, the least aggressive MPG impact scenario, this would mean the effective gas tax rate would need to be increased to about **$0.76 per gallon** without indexing, and **$0.95 per gallon** with indexing.

Higher Electric Vehicle Forecast. With the higher electric vehicle forecast, State gas tax rates (including GRT) would have to be increased to almost **$0.95 per gallon** without indexing, and more than **$1.17 per gallon** with indexing. That is about **three times the current rate** per gallon; which is already third highest in the nation.

Endnotes

(1) Michael Sivak and Brandon Schoettle, University of Michigan Transportation Research Institute, *Monthly Monitoring of Vehicle Fuel Economy and Emissions,* June 2016.

(2) U.S. Energy Information Administration, *Annual Energy Outlook 2016,* Reference case, May, 2016.

(3) *Electric Vehicles to be 35% of Global New Car Sales by 2040,* Jennifer MacDonald, Bloomberg New Energy Finance, February, 2016

(4) Information provided by Connecticut Department of Transportation, including its online publication entitled "*Transportation Fast Facts*".

(5) *State Fuel Tax Rates*, U.S. Energy Information Administration, August 2016.

(6) *Approaches to Making Federal Highway Spending More Productive*, Congressional Budget Office, February, 2016.

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